EXPLORING STUDENTS PERCEPTIONS OF TEACHING, SOCIAL, COGNITIVE PRESENCES, EFFECTIVENESS FOR TEAMWORK AND LEARNING OUTCOMES

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ABSTRACT

The three elements of the Community of Inquiry (CoI) Model which is known as teaching, social and cognitive presences can lead to successful educational experiences in a computer mediated online environment. However, current research has shown mixed-findings and little empirical evidences in supporting these elements leads to deep and meaningful learning outcomes. This study aims at investigating the relationships among students' perceptions of CoI elements, effectiveness for teamwork and students learning outcomes through pre-post-tests. Experimental research design consisting of experimental and control groups were conducted through the use of an e-collaboration environment and traditional-in-class-collaboration respectively by the two groups. Data was collected using CoI and effectiveness questionnaires, pre-test and post-test questions. The results from multiple regression and correlation analyses show that the values of the Pearson's correlation of five variables, R and R^2 are positive and statistically significant. These results confirmed the statistical relationship among the five variables to be positive and significant. The results also demonstrated that the linear combination of the four predictors' variables strongly predicts the learning outcomes. These results have confirmed the relationship among the three elements of CoI, effectiveness for teamwork and student's learning outcomes.

Keywords: collaborative learning, empirical validation, deep and meaningful learning, Community of Inquiry, actual learning outcome.

INTRODUCTION

E-Collaborative teaching and learning has been heralded as the educational experience that can improve motivation and performance and lead to less isolation [1]. Researchers have also reported "that meaningful and worthwhile learning is associated with collaborative communities of inquiry" [2] where students collaboratively learn together with the instructor serving as facilitator and moderator.

The three elements of the Community of Inquiry Model (CoI) which is known as teaching, social and cognitive presences can lead to successful educational experiences in a computer mediated online environment. However, current research has shown mixed-findings and little empirical evidences in supporting these elements will result in deep and meaningful learning outcomes [3-6]. More importantly, it has also been reported that "the reliance of prior CoI studies on students' self-reports of learning may suggest a potential and important research limitation" [6].

The goal of this study is therefore to investigate the relationships among students' perceptions of teaching presence, social presence, cognitive presence, and effectiveness-for-team-work on one hand. Secondly, the study also seeks to investigate the relationship among the four elements and students learning outcomes through pre-post-tests.

RELATED WORK

Deep and meaningful learning

Meaningful and deep learning are related concepts. Deep learning refers to "the critical examination of new facts and the effort to make numerous connections with existing knowledge structures" [3].

Meaningful learning is the conception that the new knowledge to acquire is related with previous knowledge. It emphasizes on relating new information to information already known by the learner. Meaningful learning is associated with problem-based and discovery learning approaches where the learners are expected to formulate relationship between new and existing concepts. According to Fyrenius, *et al.* [7], there are three related prerequisites to meaningful learning: pre-understanding, relevant context, and activities. This study involve the use of problem-based, discovery and brainstorming approaches after which learning was measured using post-test and students perceive collaborative learning.

The COI model

The community of inquiry model by Garrison, *et al.* [8] posits that an authentic educational experience occurs within the community of teachers and students and through the interaction of three key elements: teaching presence, social presence, and cognitive presence. These elements are important for successful educational experiences in online or computer-mediated learning environments in higher educational institutions. According to Garrison, *et al.* [8], the CoI model is to encourage and foster critical enquiry, critical thinking, critical reflection, discourse as well as deep and meaningful learning among higher education students and teachers. However, depending on its use, the quality of the educational experiences and learning outcomes can be impacted positively or negatively by the three elements.

The CoI Model is built on social-constructivist learning and instruction approaches and it is to serve as an aid to facilitate student-teacher communication and interaction in a computer-mediated online environment. The model is also to serve as an aid for critical reflection by students and critical discourse between students and teacher and among students [8]. It is also emphasized that a computer-mediated learning environments should incorporate the three elements of teaching, social and cognitive presences so as to inspire "the development and practice of higher-order thinking skills" [8].

More importantly, the CoI model also assumed that three types of interactions: student-content, student-student and student-teacher are important in other to support authentic learning. Thus, in this study, a collaborative learning experience based on experimental research design in a blended mode was conducted in a higher educational institution. The methodology employed quantitative approach in collecting and analyzing the data. Data was collected using the CoI survey instruments and a self-constructed survey instrument entitled Effectiveness for Teamwork. Table-1 illustrates the three key elements of CoI, their sub-categories and indicators.

Table-1. The CoI coding template [8].

Elements	Categories	Indicators (examples only)
Cognitive Presence	Triggering Event	Sense of puzzlement
	Exploration	Information exchange
	Integration	Connecting ideas
	Resolution	Apply new ideas
Social Presence	Emotional Expression	Emotions
	Open Communication	Risk-free expression
	Group Cohesion	Encouraging collaboration
Teaching Presence	Instructional Management	Defining and initiating discussion topics
	Building Understanding	Sharing personal meaning
	Direct Instruction	Focusing discussion

Social presence is the ability of participants in the CoI to be able to identify with the community of learners or study partners, their ability to project and present their personal characteristics into the online community as real person and not as faceless contributors. It also include the degree to which sense of belonging is felt among those participants, the ability of participants to thrust the environment, communicate purposefully and develop interpersonal relationships [9]. The three main indicators of social presence are affective expression (ability of learners to share their personal values, beliefs, emotions and feelings online), open communication (ability to communicate in a reciprocal and respectful manner), and group cohesion (showing a sense of group commitment). Research has shown that social presence cannot by itself lead to the development of critical discourse likewise "it is difficult for such discourse to develop without it" [10, 11]. On the other hand, some researchers sees "social presence as a mediating variable between teaching presence and cognitive presence" [10] [9].

Teaching presence consists of two main activities; the design of the course content and the facilitation of learning processes [8, 12]. Teaching presence can be carried out by any participant in a CoI; nevertheless, in an educational environment, this can be the sole responsibility of the teachers or instructors. The first of these activities, the design of the course contents involve the selection, design, organization and development of teaching and learning materials and assessments criteria. The second activity, the facilitation of learning processes, can be shared by both the teacher and the students in the community of inquiry. This will involve some elements of students-teacher or students-students interactions. It is believed that teaching presence is a means to an end to support and enhance social and cognitive presence for the purpose of realizing educational outcomes. Thus, the roles of the instructor in online learning environment are collectively referred to as teaching presence [3].

Cognitive presence is the extent and the ability to which the participants or students within a community of inquiry are able to construct meaning and confirm it through sustained communication. It consist of four element: the triggering event (identifying problem or issues), exploration (individually or collaboratively exploring or investigating the problem through search for information that help students make sense of the problem), integration (constructing and attaching meaning to the identified problem) and resolution (applying new knowledge to educational context or workplace) [8, 12, 13].

Practical application of the CoI model

Over the years, researchers have extended the CoI model into different areas such as its application to

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distance education, online education, and blended learning [14-17] respectively.

Maddrell, *et al.* [6] examined the relationship among social, teaching, and cognitive presences, CoI, student-perceived learning, and satisfaction. Using a sample size of 51 graduate students, from five distance education courses, their results show that there were significant positive relationships among the five studied variables (social, teaching, and cognitive presences, student-perceived learning and satisfaction). In addition, the cognitive presence subscale also significantly positively correlated ($r2 = .08$) with one of the three instructor-assessed learning achievement measures. However, the relationship between the CoI composite score and any of the three instructor-assessed learning achievement measures did not show any relationship.

Traver, *et al.* [13] employed the CoI model to investigate either students in community colleges in the United States complete online courses. The methodology include the use of pre/posttest CoI survey to examine students' perceptions of the CoI presences in 17 blended, courses at Queensborough Community College. The data from student's perception of CoI presences in addition to demographic and status variables were then correlated with the data of their completion of the study courses. Result shows that there was no significant differences between course completers and non-completers on any CoI indicators or demographic/status variables.

In addition, Akyol and Garrison [2] explored the relationship among social presence, teaching presence, cognitive presence, perceived learning and satisfaction with fifteen (N=15) students. The results from a correlational analysis demonstrated that apart from the relationship between social presence and perceived learning which did not indicate a significant relationship; there were significant positive relationships between perceived learning and teaching presence ($r=.55$, $p=.03$), between cognitive presence and teaching presence ($r=.78$, $p=.001$), between satisfaction and teaching presence ($r=.63$, $p=.01$), between perceived learning and cognitive presence ($r=.67$, $p=.007$), between satisfaction and cognitive presence ($r=.65$, $p=.009$), and between satisfaction and social presence and ($r=.54$, $p=038$).

On the contrary, Pollard and andAndree Swanson [5] suggested a modification to the CoI model by the inclusion of instructor social presence. In investigating the new inclusion the researcher examined the impact of teaching, social, and instructor social presence with a sample size of 137 in the school of Business of an online university. Their findings revealed that Instructor social presence reflected a significant impact on community and the learning environment.

Similarly, the community of inquiry model has also been modified by Annand [18] to include a fourth element, learning presence. Learning presence is described as "the proactive stance adopted by students who marshal thoughts, emotions, motivation, behaviors, and strategies in the service of successful online learning" [19]. The three indicators of learning presence are: "1) forethought and planning, where students plan, coordinate, and delegate online tasks to themselves or others; 2) monitoring, where students check with online classmates for understanding, note their completion of tasks, and evaluate and monitor their performance on online activities; and 3) strategy use, where students seek, offer, or provide help to complete an online activity, and where students articulate gaps in their knowledge" [19].

Thus, to add to the body of knowledge in this field, this study seeks to investigate the relationship among social presence, teaching presence, cognitive presence, effectiveness-for-team-work and actual learning. Thus, in addition to the adoption of the CoI survey instrument for this study, a different set of questionnaire was developed to measure the effectiveness for teamwork/collaboration. In addition, post-test results were used as a measure of actual learning. Data was therefore collected and analyzed using quantitative approaches as described in the next section.

METHODOLOGY

Participants

The participants in this study are one hundred and two (N-102) undergraduate students from two courses: Introduction to Business Information System Course and Data and Information Management Courses at University Teknologi PETRONAS (UTP). Each of the two classes was divided into two major groups: experimental group (n=60) and control group (n=42) totaling N=102 participants.

Instrumentation

The CoI Survey instruments, the effectiveness for teamwork questionnaire, the pre-test and post-test questions, were the main instruments for data collection. The questionnaires aimed at collecting students' demographic information as well as their perceptions of the three elements of CoI survey instrument, which consisted of 34 items and categorized into three main elements: social, teaching, and cognitive presences. The effectiveness for teamwork questionnaires also consisted of 24 questions categorized into six main parts: attractiveness, simple-navigation, consistency, visibility, controllability, and efficiency. All questionnaires were scored using five-point likert scale ranging from '1=strongly disagree' to '5=strongly agree'. In addition, the pre-test and post-tests questions consisted of 20 questions and the questions were based on the subject area.

Experimentation and data collection

Collaborative learning can take place with the use of technology (electronic collaboration) or without the use of technology (traditional-in-class collaboration). This study employed the two forms of collaborative teaching and learning in an experimental design that involve two undergraduate classes undertaken an Introduction to Business Information System and Data and Information

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Management. Experimentation was conducted using each of the courses in different semester. Before starting the experimentation, the class is randomly divided into two major groups: the control and experimental groups. The control group were involved with the traditional in-class collaboration and consisted of forty-two (n=42) participants. While the experimental group consisting of sixty (n=60) participants used e-collaboration system entitled Teach, Learn and Research E-collaboration System (TELERECS) for online collaboration. Each of these groups was further divided into sub-groups of between four to six participants.

Figure-1 and Figure-2 illustrate the key steps and the implementation process followed in the experimental design for the experimental and control groups respectively. In Figure-1, the experimental group has to use a TELERECS e-collaboration system after the instructor invited members through email, the instructor then use the system to randomly form sub-groups of between 4-6 members. Each member can then authenticate themselves through user login. This is followed by a walkthrough of the system with the instructor for participants to get familiarize and introduce themselves to the community of inquiry (group members).
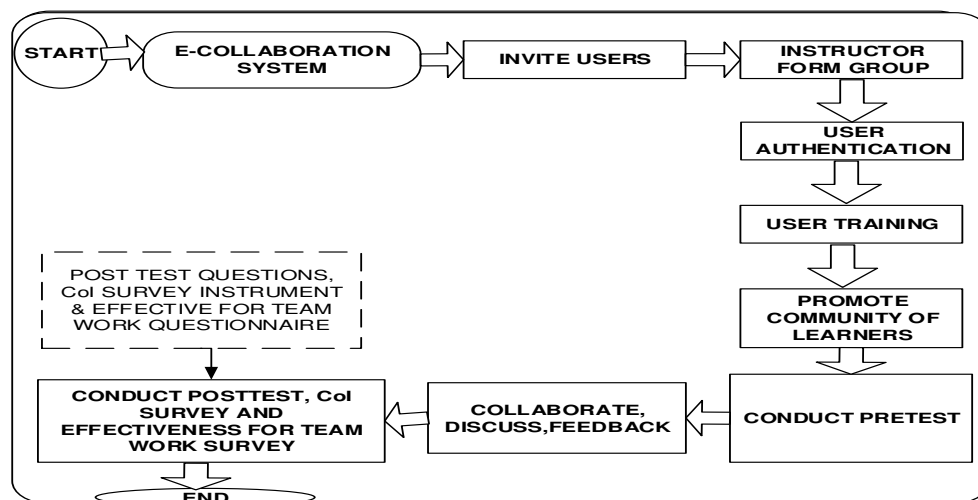

Figure-1. Experimental group implementation process.

Similarly, in Figure-2, the instructor formed sub-groups of between 4-6 members after introducing the collaborative process to the control group. Members will then have to introduce themselves to their colleagues. A pre-test was conducted to the control group in fourth week. This was followed by the instructor introduction of group-based tasks in the form of problem-based, brainstorming, etc. for students to collaboratively solve. Then, a post-test was conducted in the tenth week of the semester.
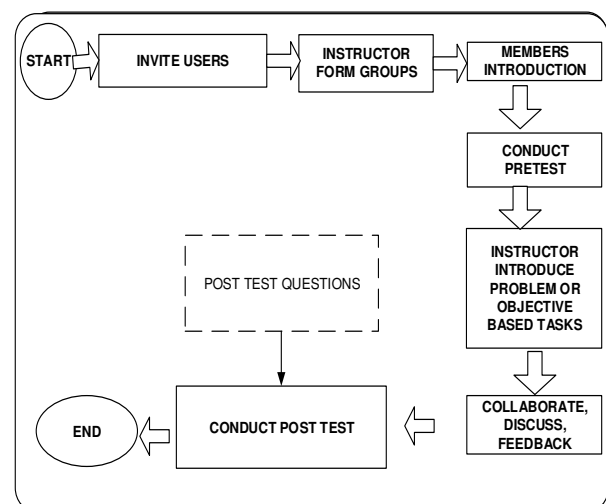

Figure-2. Control group implementation process.

After the above processes, a pre-test was conducted for the two groups in the fourth week of the semester. Then the two groups were made to collaboratively solve problem-based and case-based tasks through interaction, discussion, posting, editing and providing feedbacks. While the experimental group carried out the collaboration activities using TELERECS

e-collaboration environment, which involved students-students, student-instructor, and students-contents interaction; the control group carried out their collaboration activities in the classroom in the presence of the instructor. Both groups' collaboration process and activities mandatorily took place two hours per week for six weeks. However, the experimental group can still do collaboration at any other time since the TELERECS system is available online.

In the tenth week of the semester, both groups then undertook post-test to measure learning and performance. In addition, the experimental group participated in two surveys using the CoI and effectiveness for teamwork questionnaires. This study therefore reported on the data derived from the experimental group, which consisted of 60 participants.

Data analysis

Descriptive analysis was conducted on the data to find the mean score among the variables. Secondly, the Pearson Moment Correlation Coefficient and multiple regression analyses was conducted on data to investigate the relationships among five variables of social presence, teaching presence, cognitive presence, effectiveness for team work, and post-test scores. Finally, the following null hypothesis (H_01) was tested:

H_01: Students perceived cognitive presence, social presence, teaching presences, and effectiveness for team work will not have a positive and significant effect on learning Outcomes.

The hypothesized relationships model among the variables as shown in Figure-3 was analyzed using Pearson's Product-Moment Correlation.
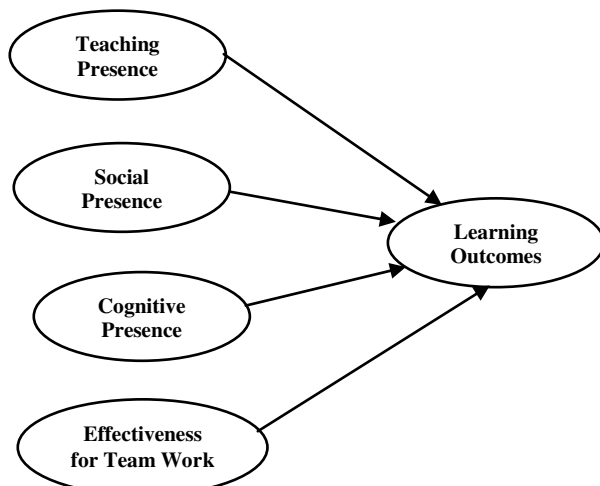

Figure-3. Hypothesized relationships model.

RESULTS AND DISCUSSIONS

The purpose of this study was to investigate the relationships among the CoI presences as well as to gain the quantitative association of each of the presences to students learning outcome through post-test scores.

The current study report on the experimental group's statistics since they have used the system named TELERECS for e-collaboration and has participated in the surveys. The descriptive analysis of the data as illustrated in Table-2 shows that 60 students participated in the surveys. In addition, the mean for all the variables in Table-2 were greater than 4 out of the maximum of 5. While the standard deviations of the variables ranges from 0.28 for teaching presence to 0.49 for effectiveness for teamwork. The closer the Standard Deviation is to 0, the more reliable the Mean is. Therefore, the values of the standard deviations in this study imply that most of the values are positioned very close to the mean. This also indicated that there is very little volatility in the sample. The students also agreed that the e-collaboration environment is effective and useful for team work (M=4.07).

Table-2. Descriptive statistics of studied variables.

	Mean	Std. Dev.	N
Post-Test-Scores	4.09	.358	60
Teaching Presence	4.11	.280	60
Social Presence	4.11	.380	60
Cognitive Presence	4.10	.335	60
Effectiveness for eamwork	4.07	.487	60

The Pearson Moment Correlation Coefficient was conducted on data to explore the relationships among five variables: social presence, teaching presence, cognitive presence, effectiveness for team work, and post-test scores. As illustrated in Table-3, the results of the analysis revealed statistical positive and significant relationships among the five variables.

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Table-3. Correlations among studied variables (N=60).

		Post-test-scores	Teaching presence	Social presence	Cognitive presence	Usefulness for team work
Pearson Correlation	Post-Test-Scores	1.00				
	Teaching Presence	.55	1.00			
	Social Presence	.73	.78	1.00		
	Cognitive Presence	.68	.52	.73	1.00	
	Effectiveness for Teamwork	.35	.58	.55	.39	1.00
Sig. (1-tailed)	Post-Test-Scores	.				
	Teaching Presence	.000	.			
	Social Presence	.000	.000	.		
	Cognitive Presence	.000	.000	.000	.	
	Effectiveness for Teamwork	.003	.000	.000	.001	.

The results in Table-3 demonstrated that there was a positively significant relationship between social presence and teaching presence (r=0.78, p<0.01), between social presence and cognitive presence (r=0.73, p<0.01), between cognitive presence and teaching presence (r=0.52, p<0.01), between social presence and post-test scores(r=0.73, p<0.01), teaching presence and post-test scores (r=0.55, p<0.01), and between cognitive presence and post-test scores (r=0.68, p<0.01). These results imply that students who perceived higher levels of social presence also perceived higher levels of teaching presence and cognitive presence. These further lead to higher scores or learning outcome.

The results also shows that there was positive significant relationship between effectiveness-for-teamwork and post-test score (r=0.35, p<0.05), between effectiveness-for-teamwork and teaching presence (r=0.58, p<0.05), between effectiveness-for-teamwork and social presence (r=0.55, p<0.05), between effectiveness-for-teamwork and cognitive presence (r=0.39, p<0.05). These results also imply that perceived effectiveness-for-teamwork has statistical positive relationship with other variables.

Overall, the results in Table-3 demonstrated that there was a positive significant relationships among all the five variables; all variables were also statistically significant as p<0.05. Social presence and teaching presence depicted the strongest relationship of .78. This was followed by correlation between cognitive presence with social presence (0.73) and post-test score with social presence (0.73). These were then followed by the correlations between post-test scores and cognitive presence (0.68), post-test scores and teaching presence (0.55), and finally, cognitive presence and teaching presence (0.52). The fact that these variable are positively correlated are indication that as one variable increases in value, the second variable that is been correlated with also increases in value. These findings have important

theoretically and practical implications by confirming the statistical relationship among the five variables.

These results is supported by the argument that "instructor-driven measures may provide a way forward in the search for proof that a CoI leads to deep and meaningful learning outcomes" [4]. In addition, the results from this study further "support the call for new research to examine which interaction conditions and at what level of interaction intensity contribute to student achievement" (Abrami *et al.*, 2011; Anderson, 2003; Bernard *et al.*, 2009) [4]. It is therefore important to evaluate multiple-linear-regression on the data to predict the behavior of all variables that constitute the model.

Findings from multiple regression models are shown in Table-4, Table-5 and Table-6. The four predictors' variables are: Effectiveness-for-Teamwork, Social Presence, Teaching Presence, and Cognitive Presence. The dependent variable is Post-Test-Scores.

Table-4 illustrates the model summary result. The value of R in multiple regressions illustrates the Pearson product moment correlation coefficient between dependent variable and independent variables. In this study, the predictors' variables (Effectiveness-for-Teamwork, Cognitive Presence, Teaching Presence, and Social Presence) and the dependent variable (Post-Test Scores) are positively correlated and the strength of the relationship is strong at 0.766. The result of 0.766 implies that the linear combination of the four predictors' variables strongly predicts the post-test scores.

Table-4. Model summary[b].

Model	R	R^2	Adjusted R square	Std. error of the estimate
1	.766[a]	.586	.556	.239
a. Predictors: (Constant), Effectiveness for Team Work, Cognitive Presence, Teaching Presence, Social Presence				
b. Dependent Variable: Post-Test-Scores				

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The R^2 value in Table-4 is 0.586, which suggest that the linear combination of the predictors' variables explain 58.6% of the variations in post-test scores. This result indicated that the relationship between the predictors' variables and post-test scores is moderately strong. The results also confirm that the predictors' variables predict Post-Test-Scores (learning outcomes) for 58.6% of the cases.

In addition, research has shown that, "the smaller the standard error, the better the prediction, that is, the better the linear regression fits the cloud of points" [20]. In this study, the value of the standard error is 0.23, which is small. This suggests that the prediction is better.

Therefore, the results from the multiple regression with all the five variables as shown in Table-4 and Table-5 produced: $R^2 = 0.586$, $F(4, 55)=19.472$, $p<0.001$.

Table-5 shows the results of significance for R and R^2 using the F-statistic. The p-value in Table-5 is 0.00, which is lower than 0.05. This illustrate that the R and R^2 between predictors variables and post-test score is statistically significant.

Table-5. ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	p.
1	**Regression**	**4.434**	**4**	**1.108**	**19.472**	**.000[b]**
	Residual	3.131	55	.057		
	Total	7.565	59			
a. Dependent Variable: Post-Test-Scores						
b. Predictors: (Constant), Effectiveness for teamwork, cognitive presence, teaching presence, social presence						

Finally, Table-6 shows p values, the t values and the beta coefficient results under the unstandardized coefficient column for each of the predictors' variables. Apart from students perceived effectiveness-for-team-work variable that shows negative β value, the rest of the predictor variable have positive results. These results imply that there is positive and significant relationship between social presence and post-test scores, as well as between cognitive presence and post-test scores since the p-value is less than 0.05. Contrary to this, there is positive, but insignificant relationship between teaching presence and post-test scores. Furthermore, effectiveness-for-

teamwork also has negative β value and insignificant relationship with post-test scores. These results implies that variables teaching presence, social presence and cognitive presence are significant predictors of learning outcomes as the coefficient of variable, effectiveness-for-team-work is not significant.

Thus, based on Table-6, the equation for the regression line is:
Y = 0.803 + 0.006(Teaching Presence) + 0.500(Social Presence + 0.341(Cognitive Presence) - 0.049(Effectiveness for Team Work).

Table-6. Coefficients[a].

Model		Unstandardized coefficients		Standardized coefficients	t	p
		B	Std. error	Beta		
1	(Constant)	.803	.519		1.549	.127
	Teaching Presence	.006	.188	.005	.033	.974
	Social Presence	.500	.168	.531	2.975	.004
	Cognitive Presence	.341	.138	.319	2.474	.016
	Effectiveness for Team Work	-.049	.080	-.067	-.618	.539

CONCLUSIONS AND FUTURE WORK

The results of this study have important theoretically and practical implication by confirming the statistical relationship among the five variables to be positive and significant as shown in Table-3. This result has confirmed that there is statistical positive relationship between the four variables and objective measure of

learning. Secondly, the result also demonstrated that the linear combination of the four predictors' variables strongly predicts the post-test scores as illustrated in Table-4. Therefore, since the values of the Pearson's correlation, R and R^2 are positive and statistically significant we can conclude that the null hypothesis ($H_0 1$) is rejected while the alternative hypothesis is accepted.

These results also imply that the predictors' variables lead to meaningful learning outcomes.

Future work will include to furthers examine the effects of social presence, teaching presence, cognitive presence, effectiveness-for-teamwork on actual learning outcomes and compare results with the current study. Future work should also uncover additional determinants of student learning outcomes to be incorporated.

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